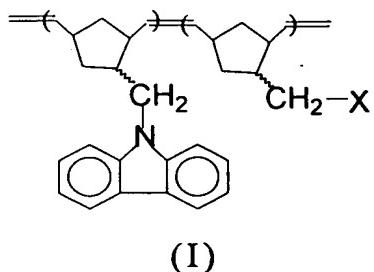


WHAT WE CLAIM IS:

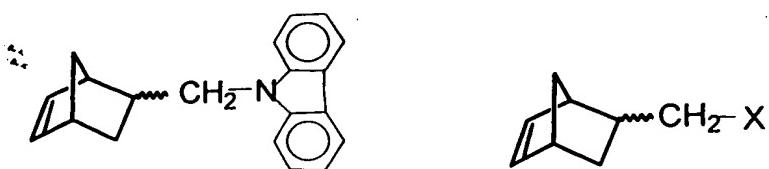
1. A diblock macroinitiator containing norborene and carbazole segments comprising the formula (I):



(I)

wherein, X is one selected from a group consisting of Br and Cl.

2. The diblock macroinitiator according to claim 1, wherein, said diblock macroinitiator is prepared from a mixture of carbazole-containing norbornene-type monomer (II) in the presence of catalyst *via* ring-opening metathesis polymerization, an additional norbornene derivative(III) is added into the mixture after 15~120 mins of commencing ring-opening metathesis polymerization and said diblock macroinitiator is obtained, wherein,



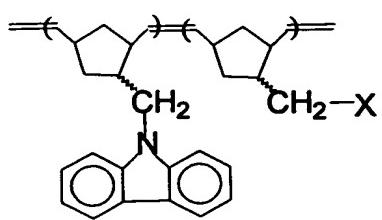
(II)

(III)

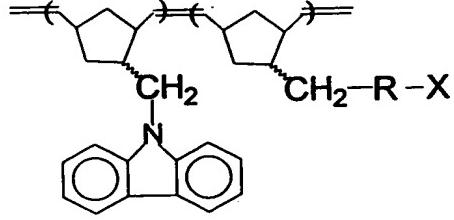
wherein, X is one selected from a group consisting of Br and Cl.

3. The diblock macroinitiator according to claim 2, wherein, said metathesis catalyst is $\{\text{Cl}_2\text{Ru}(\text{CHPh})[\text{P}(\text{C}_6\text{H}_{11})_3]_2\}$.

4. A polynorbornene-containing grafted copolymer comprising the formula (IA), which is prepared by using a diblock macroinitiator with the formula (I):



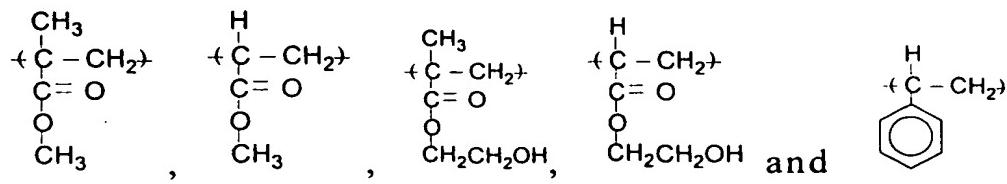
(I)



(IA)

wherein, X is one selected from a group consisting of Br and Cl; and

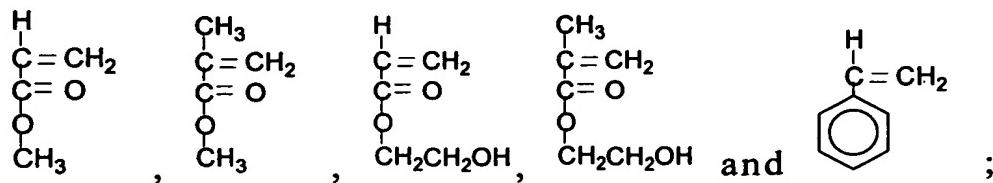
R is one selected from a group consisting of



5. A method for preparing a grafted polynorbornene with the formula (IA) comprises of following steps :

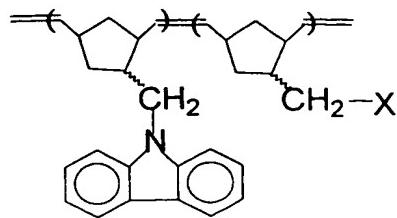
a) Preparation of a macroinitiator with the formula (I) by means of reaction of cabazole-containing norbornene-type monomer (II) and a catalyst *via* ring-opening metathesis polymerization and addition of additional norbornene derivative(III) into the mixture after 15~120 mins of commencing ring-opening metathesis polymerization;

b) preparation of a mixture of Cu(I)Br, 2,2'-bipyridine, said macroinitiator (I) and a monomer selected from a group consisting of

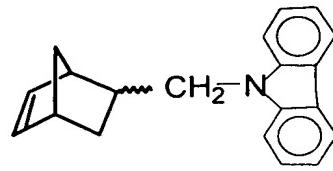


and

c) preparation of said grafted polynorbornene copolymer with the formula (IA) by means of a graft copolymerization of said mixture at various temperatures ranged from 50 to 150 °C, wherein,



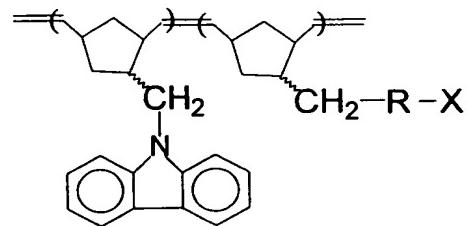
(I)



(II)



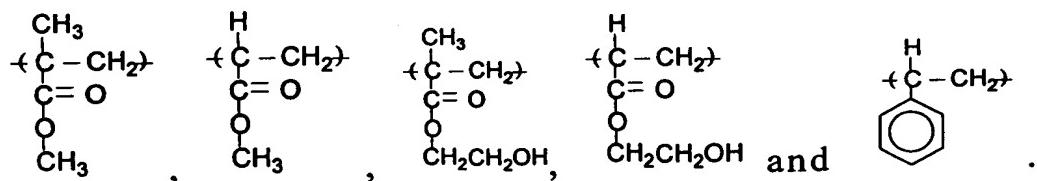
(III)



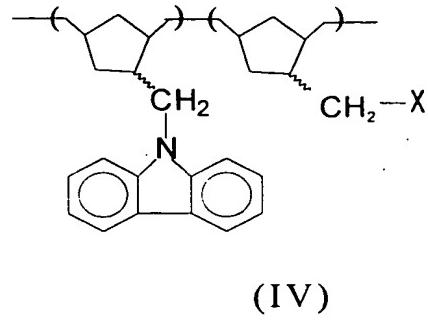
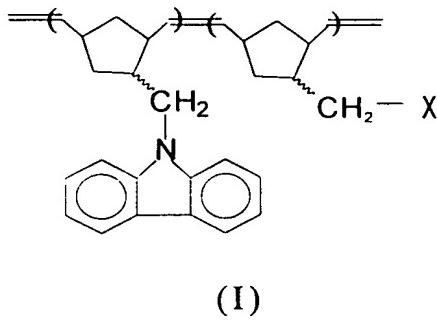
(IA)

wherein, X is one selected from a group consisting of Br and Cl; and

R is one selected from a group consisting of

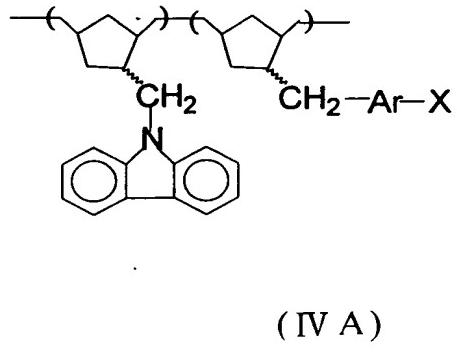
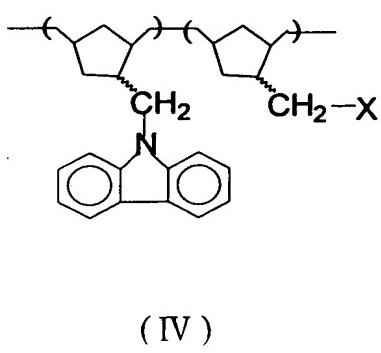


6. A thermally-stable saturated cyclic aliphatic diblock macroinitiator comprising the formula (IV), which is prepared by hydrogenating a diblock macroinitiator with the formula (I):



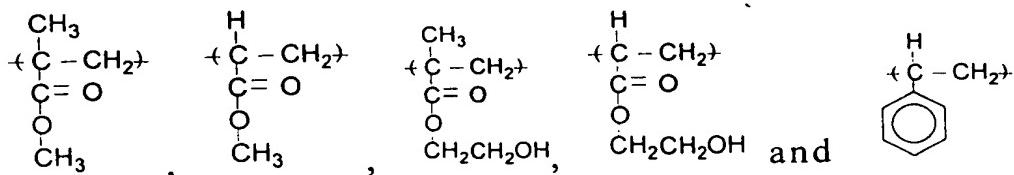
wherein, X is one selected from a group consisting of Br and Cl.

7. A polynorbornene-containing grafted copolymer comprising the formula (IVA), which is prepared by graft copolymerization by using a diblock macroinitiator with the formula (IV):



wherein, X is one selected from a group consisting of Br and Cl; and

Ar is one selected from a group consisting of

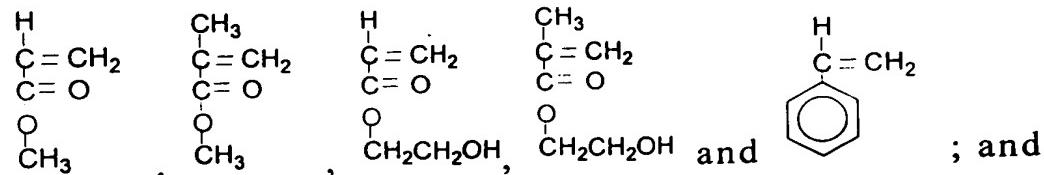


8. A Method for preparing a grafted polynorbornene with the formula (IVA) comprises of following steps:

a) Preparation of a macroinitiator with the formula (I) by means of reaction of cabazole-containing norbornene-type monomer (II) and a catalyst *via* ring-opening metathesis polymerization and an additional norbornene derivative(III) was added into the mixture after 15~120 mins commencing of ring-opening metathesis polymerization;

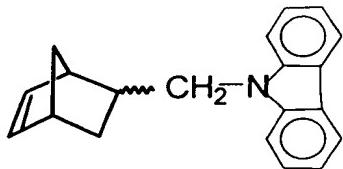
b) hydrogenation of said diblock macroinitiator with the formula (I) to prepare a thermally-stable saturated cyclic aliphatic diblock macroinitiator with the formula (IV);

c) preparation of a mixture of Cu(I)Br, 2,2'-bipyridine, said thermally-stable saturated cyclic aliphatic diblock macroinitiator (IV) and a monomer selected from a group consisting of

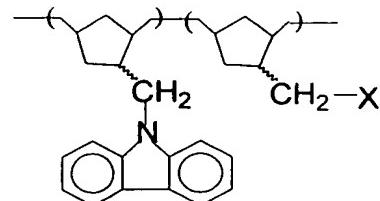


d) preparation of said grafted polynorbornene copolymer with the formula (IVA) by means of a graft copolymerization of

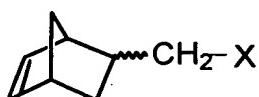
said mixture at various temperatures ranged from 50 to 150 °C,
wherein,



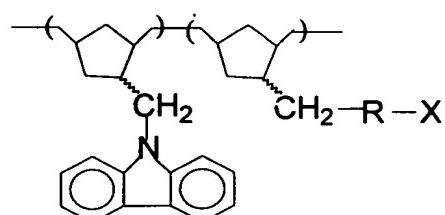
(II)



(IV)



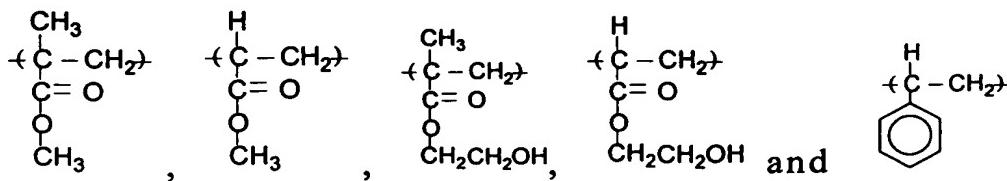
(III)



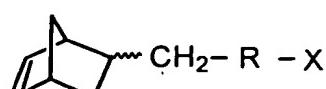
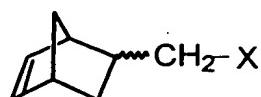
(IV A)

wherein, X is one selected from a group consisting of Br and Cl; and

R is one selected from a group consisting of



9. A norbornene-containing macrmonomer comprising the formula (V), which is prepared by using a norbornene end group-containing initiator with the formula (III):

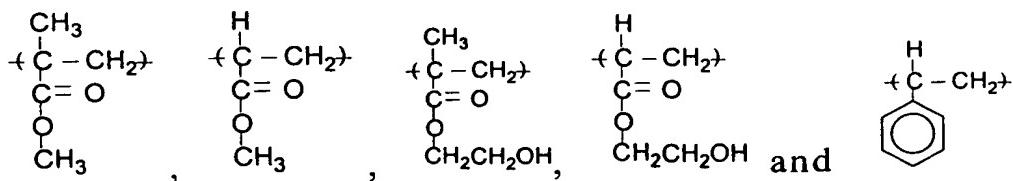


(IV)

(V)

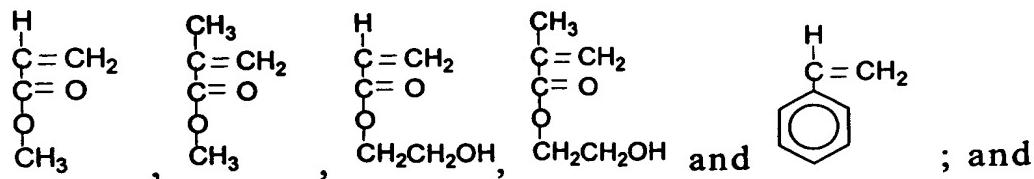
wherein, X is one selected from a group consisting of Br and Cl; and

R is one selected from a group consisting of



10. A method for preparing a norbornene end group-containing macromonomer with the formula (V) comprises of following steps:

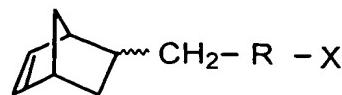
a) Preparation of a mixture of Cu(I)Br, 2,2'-bipyridine, a norbornene-type initiator (III) and a monomer selected from a group consisting of



b) preparation of said norbornene end group-containing macromonomer with the formula (V) by means of radical polymerization of said mixture at various temperatures ranged from 50 to 150 °C, wherein,



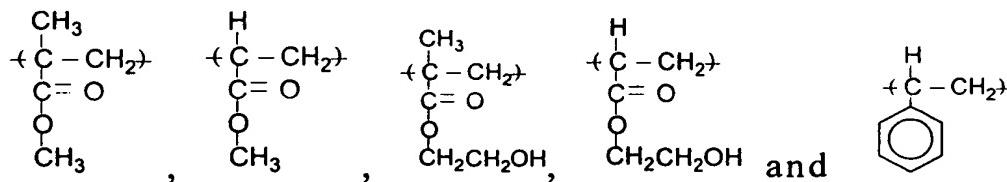
(III)



(V)

wherein, X is one selected from a group consisting of Br and Cl; and

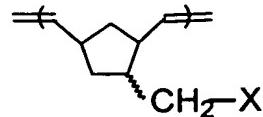
R is one selected from a group consisting of



11. A norbornene-type macroinitiator comprising the formula (VI), which is prepared by using a catalyst and a norbornene-type derivative with the formula (III) via ring-opening metathesis polymerization:



(III)

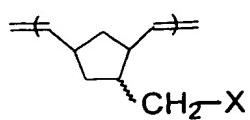


(VI)

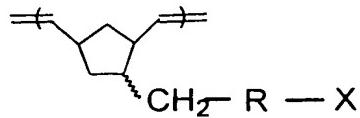
wherein, X is one selected from a group consisting of Br and Cl.

12. A polynorbornene-containing grafted copolymer comprising the formula (VII), which is prepared by using a

macroinitiator with the formula (VI) *via* graft copolymerization :



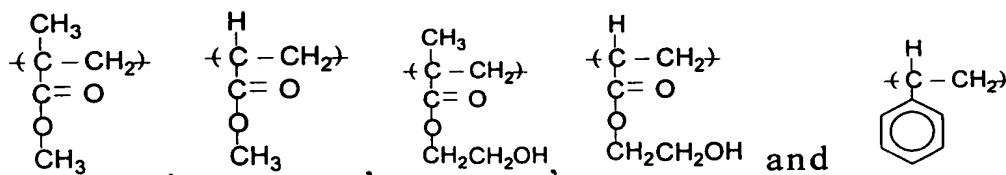
(VI)



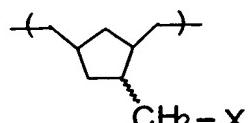
(VII)

wherein, X is one selected from a group consisting of Br and Cl; and

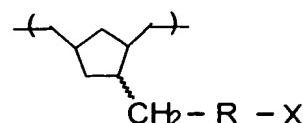
R is one selected from a group consisting of



13. A saturated cyclic aliphatic polynorbornene-containing grafted copolymer comprising the formula (IX), which is prepared by using a saturated cyclic aliphatic macroinitiator with the formula (VIII) *via* graft copolymerization :



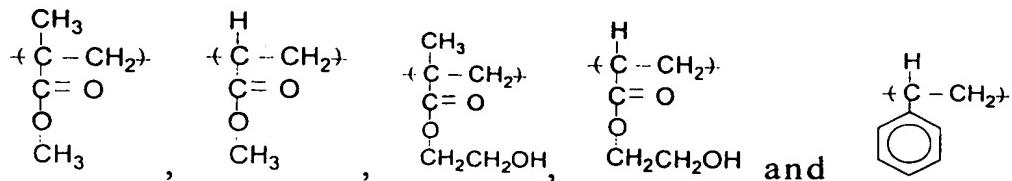
(VIII)



(IX)

wherein, X is one selected from a group consisting of Br and Cl; and

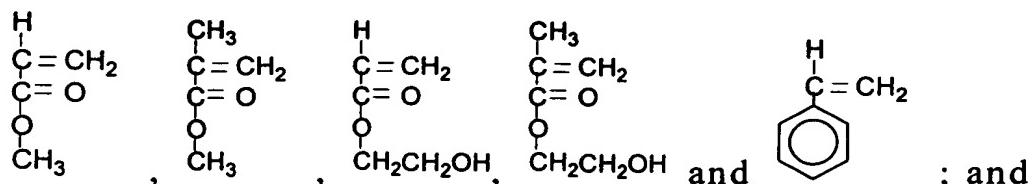
R is one selected from a group consisting of



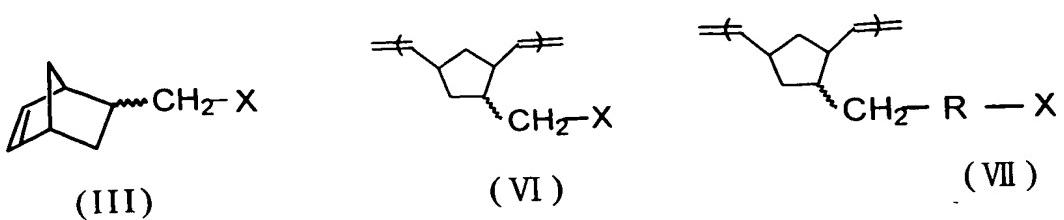
14. A method for preparing grafted polynorbornene copolymer with the formula (VII) comprises of following steps:

a) Polymerization a norbornene monomer with the formula (III) by using a catalyst *via* ring-opening metathesis polymerization, to obtain a macroinitiator with the formula (VI);

b) preparation of a mixture of Cu(I)Br, 2,2'-bipyridine, said macroinitiator (VI) and a monomer selected from a group consisting of

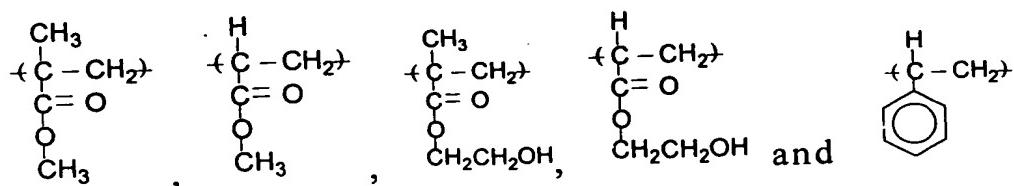


c) preparation of said grafted polynorbornene copolymer with the formula (VII) by means of a graft copolymerization of said mixture at various temperatures ranged from 70 to 150 °C, wherein,



wherein, X is one selected from a group consisting of Br and Cl; and

R is one selected from a group consisting of

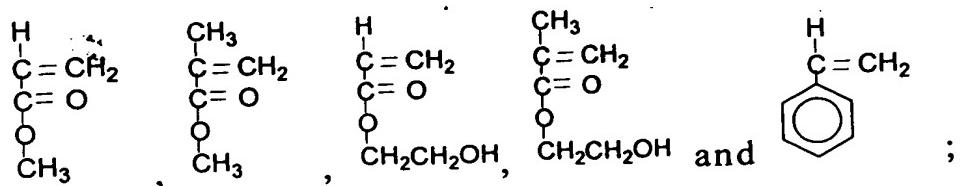


15. A method for preparing grafted polynorbornene copolymer with the formula (IX) comprises of following steps:

a) Polymerization of a norbornene monomer with the formula (III) by using a catalyst *via* ring-opening metathesis polymerization, to obtain a macroinitiator with the formula

(VI);

b) preparation of a mixture of Cu(I)Br, 2,2'-bipyridine, said macroinitiator (VI) and a monomer selected from a group consisting of



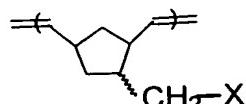
c) hydrogenation of said macroinitiator with the formula (VII) to prepare a thermally-stable saturated cyclic aliphatic macroinitiator with the formula (VIII); and

d) preparation of a grafted polynorbornene with the formula (IX) by means of radical polymerization of said mixture at various temperatures ranged from 50 to 150 °C,

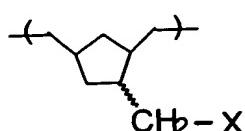
wherein,



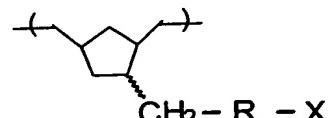
(III)



(VI)



(VII)

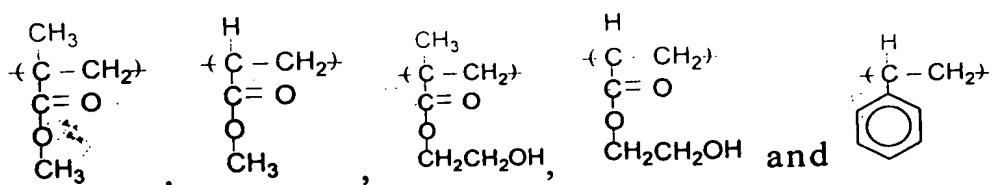


(IX)

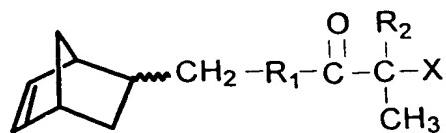
wherein, X is one selected from a group consisting of Br

and Cl; and

R is one selected from a group consisting of



16. A norbornene-type compound containing bromo-end group, having the formula (XI):



(XI)

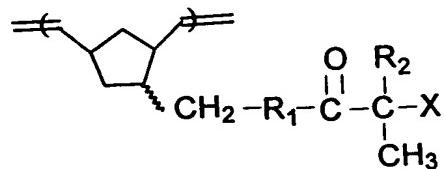
wherein, X is Br or Cl;

R₁ is -NH-, -O-, -(CH₂)_n-NH-, or -(CH₂)_n-O-,

wherein, n denotes an integer of 1 to 4; and

R₂ is H or -CH₃.

17. A polynorbornene-type macroinitiator containing halogen-side group, having the formula (XII):



(XII)

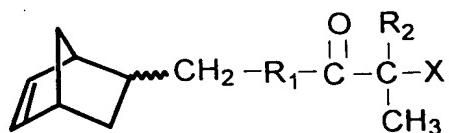
wherein, X is Br or Cl;

R₁ is -NH-, -O-, -(CH₂)_n-NH-, or -(CH₂)_n-O-,

wherein, n denotes an integer of 1 to 4.; and

R₂ is H or -CH₃.

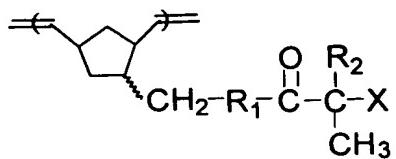
18. The macroinitiator according to claim 17, wherein, said macroinitiator is prepared from a halogen-containing norbornene-type compound (XI) in the presence of catalyst via ring-opening metathesis polymerization, wherein,



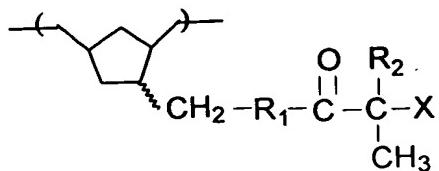
(XI)

19. The macroinitiator according to claim 18, wherein, said metathesis catalyst is {Cl₂Ru(CHPh)[P(C₆H₁₁)₃]₂}.

20. A thermally-stable saturated cyclic aliphatic macroinitiator comprising the formula (XIII), which is prepared by hydrogenating a macroinitiator with the formula (XII):



(XII)



(XIII)

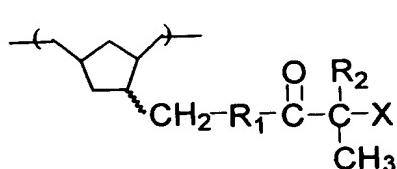
wherein, X is Br or Cl ;

R₁ is -NH-, -O-, -(CH₂)_n-NH- or -(CH₂)_n-O- ,

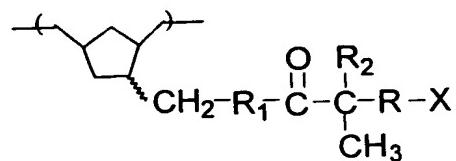
wherein, n denotes an integer of 1 to 4 ; and

R₂ is H or -CH₃.

21. A grafted polynorbornene copolymer comprising the formula (XIV), which is prepared by using a macroinitiator with the formula (XIII) *via* graft copolymerization:



(XIII)



(XIV)

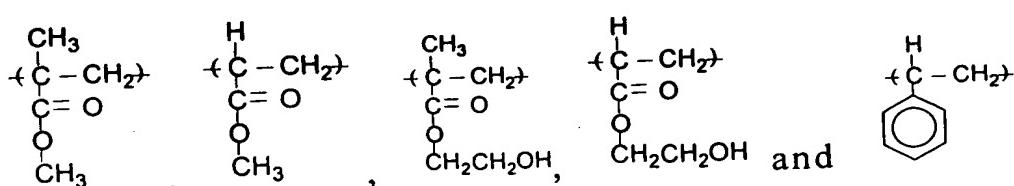
wherein, X is Br or Cl;

R₁ is -NH-, -O-, -(CH₂)_n-NH-, or -(CH₂)_n-O-,

wherein, n denotes an integer of 1 to 4 ;

R₂ is H or -CH₃; and

R is one selected from a group consisting of

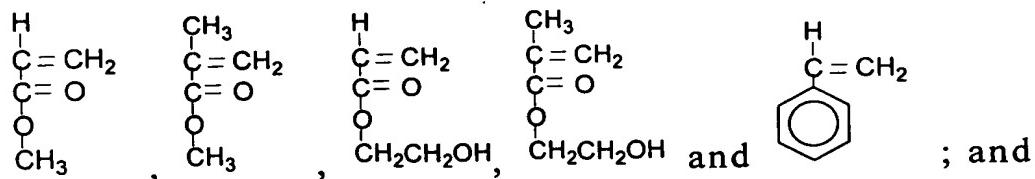


22. A method for preparing grafted polynorbornene copolymer with the formula (XIV) comprises of following steps:

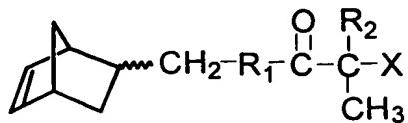
a) Polymerization of a norbornene monomer with the formula (XI) by using a catalyst *via* ring-opening metathesis polymerization to obtain a macroinitiator with the formula (XII);

b) hydrogenation of said macroinitiator with the formula (VII) to prepare a thermally-stable saturated cyclic aliphatic macroinitiator with the formula (VIII);

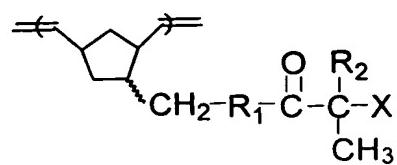
c) preparation of a mixture of Cu(I)Br, 2,2'-bipyridine, said thermally-stable saturated cyclic aliphatic macroinitiator (VIII) and a monomer selected from a group consisting of



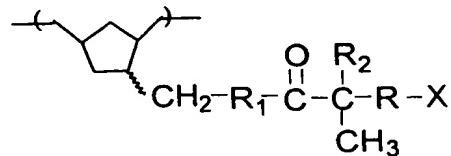
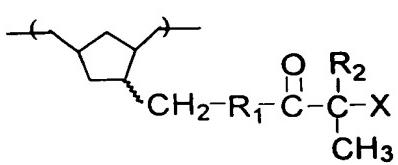
d) preparation of a grafted polynorbornene with the formula (XIV) by means of radical polymerization of said mixture at various temperatures ranged from 50 to 150 °C, wherein,



(XI)



(XII)



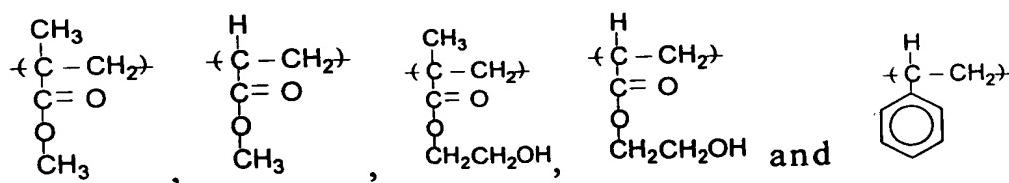
wherein, X is Br or Cl;

R₁ is -NH-, -O-, -(CH₂)_n-NH- or -(CH₂)_n-O-,

wherein, n denotes an integer of 1 to 4 ;

R₂ is H or -CH₃; and

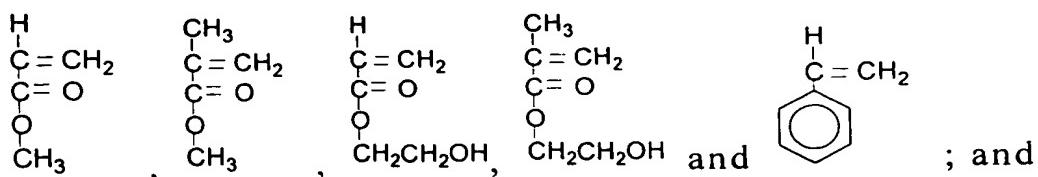
R is one selected from a group consisting of



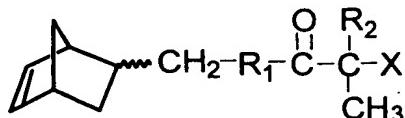
23. A method for preparing grafted polynorbornene copolymer with the formula (XIVA) comprises of following steps:

a) Polymerization of a norbornene monomer with the formula (XI) by using a catalyst via ring-opening metathesis polymerization, to obtain a macroinitiator with the formula (XII);

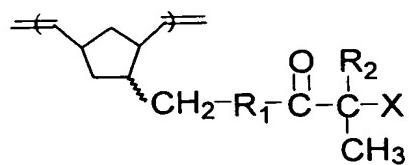
b) preparation of a mixture of Cu(I)Br, 2,2'-bipyridine, said macroinitiator (VII) and a monomer selected from a group consisting of



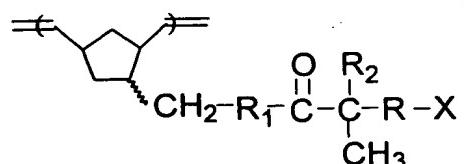
c) preparation of a grafted polynorbornene with the formula (XIVA) by means of radical polymerization of said mixture at various temperatures ranged from 50 to 150 °C, wherein,



(XII)



(XIII)



(XIVA)

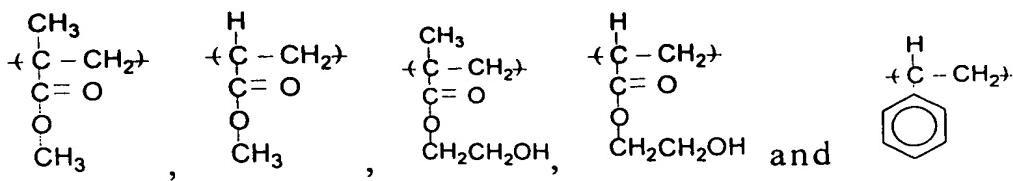
wherein, X is Br or Cl;

R₁ is -NH-, -O-, -(CH₂)_n-NH-, or -(CH₂)_n-O-,

wherein, n denotes an integer of 1 to 4;

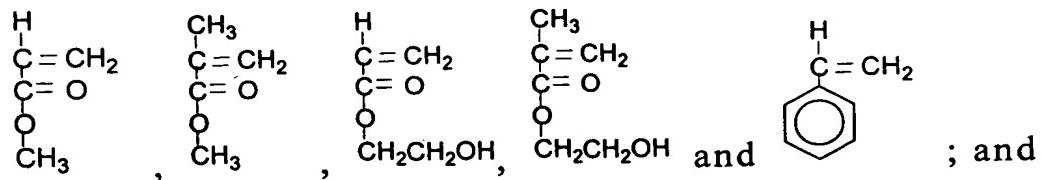
R₂ is H or -CH₃; and

R is one selected from a group consisting of

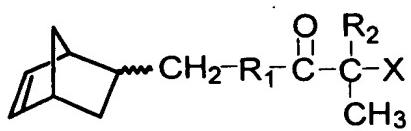


24. A method for preparing norbornene end group-containing macromonomer with the formula (XV) comprises of following steps:

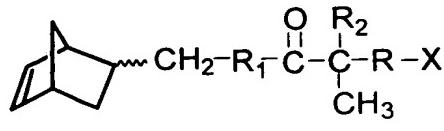
a) Preparation of a mixture of Cu(I)Br, 2,2'-bipyridine, a norbornene derivative (XI) and a monomer selected from a group consisting of



b) preparation of a norbornene end group-containing macromonomer with the formula (XV) by means of radical polymerization of said mixture at various temperatures ranged from 50 to 150 °C, wherein,



(XI)



(XV)

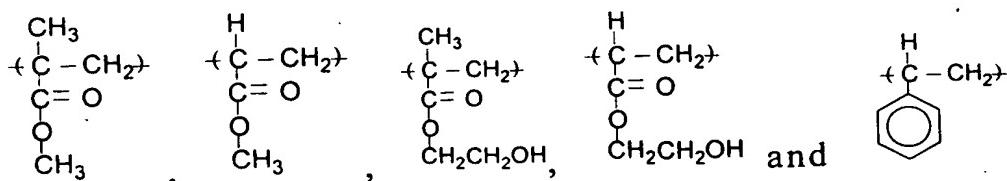
wherein, X is Br or Cl;

R₁ is -NH-, -O-, -(CH₂)_n-NH-, or -(CH₂)_n-O-,

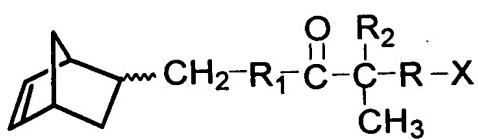
wherein, n denotes an integer of 1 to
4 ;

R_2 is H or $-CH_3$; and

R is one selected from a group consisting of



25. A norbornene end group-containing macromonomer comprises of formula (XV):



(XV)

wherein, X is Br or Cl;

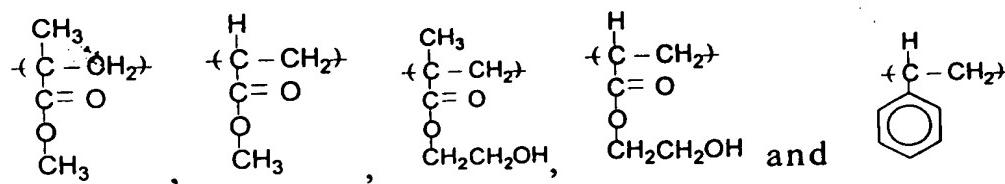
R_1 is $-NH-$, $-O-$, $-(CH_2)n-NH-$, or $-(CH_2)n-O-$,

wherein, n denotes an integer of 1 to

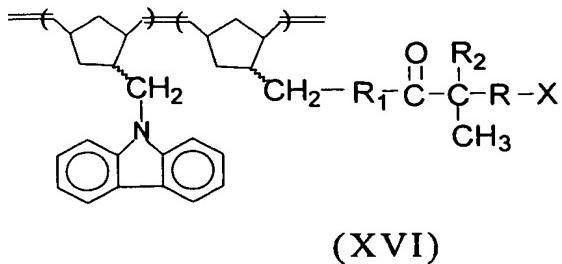
4 ;

R_2 is H or $-CH_3$; and

R is one selected from a group consisting of



26. A copolymer containing carbazole and halo- side groups comprising the formula (XVI):



wherein, X is Br or Cl;

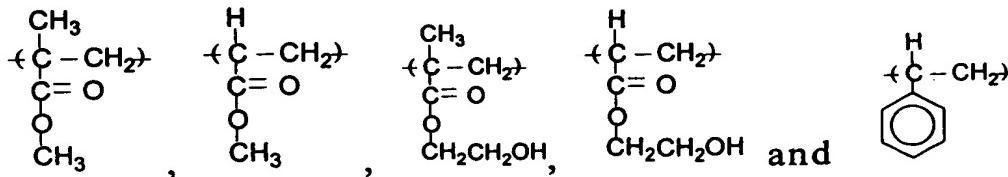
R₁ is -NH-, -O-, -(CH₂)_n-NH-, or -(CH₂)_n-O-,

wherein, n denotes an integer of 1 to

4 ;

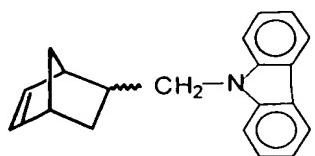
R₂ is H or -CH₃; and

R is one selected from a group consisting of

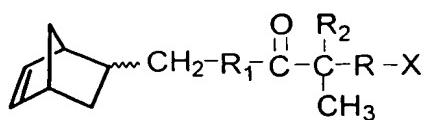


27. The copolymer according to claim 26, wherein, said copolymer macroinitiator is prepared from a mixture of carbazole-containing norbornene-type monomer (II) and a macromonomer with the formula (XV) in the presence of

catalyst via ring-opening metathesis polymerization, wherein,



(II)



(XV)

wherein, X is Br or Cl ;

R_1 is $-\text{NH}-$, $-\text{O}-$, $-(\text{CH}_2)\text{n}-\text{NH}-$, or $-(\text{CH}_2)\text{n}-\text{O}-$,

wherein, n denotes an integer of 1 to

4;

R_2 is H or $-\text{CH}_3$; and

R is one selected from a group consisting of

